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U.S. PATENT APPLICATION

FOR:

APPARATUS FOR LOCAL REDUCTION OF ELECTROMAGNETIC FIELD USING AN ACTIVE SHIELD AND METHOD THEREOF

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APPARATUS FOR LOCAL REDUCTION OF ELECTROMAGNETIC FIELD USING AN ACTIVE SHIELD AND METHOD THEREOF

Field of the Invention

The present invention relates to shield devices and more particularly pertains to a shield device which may be used to protect a user from electromagnetic fields emitted by an antenna.

Description of the Prior Art

In recent years, as the number of wireless devices has grown, so has the concern about harm to the user from electromagnetic radiation. Although the level of electromagnetic radiation emitted by such devices is relatively low, the antenna which emits the radiation is close to the head, and there is also concern that the radiation can have a cumulative effect.

In the past, there have been some attempts to protect the users of wireless devices from such radiation, however, none of those approaches has been entirely satisfactory.

Summary of the Invention

The present invention includes a method and apparatus for protecting an operator from electromagnetic fields emitted by an antenna.

The present invention further includes an apparatus having an antenna creating an electromagnetic field, and an active shield substantially canceling the effects of the electromagnetic field in a predetermined region.

The present invention further includes a communication apparatus having an antenna creating an electromagnetic field, and a plurality of active shields for canceling the effects of the electromagnetic field in a predetermined region.

The present invention further includes a communication apparatus having an antenna creating an electromagnetic field, and a means for canceling the effects of the electromagnetic field in a predetermined region.

The present invention further includes a method comprising generating an electromagnetic field from an antenna, and canceling the effects of the electromagnetic field in a predetermined region using an active shield.

Brief Description of the Drawings

Fig. 1 is a side elevational view of a communication device such as a portable telephone with active shields;

Fig. 2 is a block diagram illustrating the elements of the first embodiment; and

Fig. 3 is a block diagram illustrating the elements of the second embodiment.

Detailed Description

Fig. 1 is a side view of the portable or personal communication apparatus 10 with only a few portions of such apparatus identified. (It should be noted that although the terms personal communication apparatus, wireless communication device, wireless device, wireless telephone are used, these terms are interchangeable and mean any portable device that emits electromagnetic fields, particularly those that are frequently place near a user's head and/or person.) An antenna 12 is shown extending upwardly from the apparatus 10. Active shields or radiators 14a-14c are shown arranged between the antenna 12 and/or the RF circuitry of the device (not shown) and the operator's ear piece 10a. Active shields 14a-14c are radiating devices that substantially cancel or reduce the electromagnetic field(s) from the device 10 and/or the antenna

12 in a predetermined area. In this case the predetermined area is the operator's head which is substantially located near the radiators 14a-14c. The number of active shields may range anywhere from one to five or greater depending on the requirements of the communication apparatus 10. The active shields 14a-14c create a near field which is opposite to that produced by the antenna 12 and the device 10.

Fig. 2 illustrates a block diagram of a first embodiment. Antenna 12 is connected to the RF circuitry section of the device (not shown in Fig. 2) which contains a controller (e.g., microprocessor) through line 16. The controller may be the main controller of the communication device 10 or an extra controller. Located between antenna 12 and the RF circuitry section of the device is a coupler 20. Coupler 20 diverts a small portion of the signal (approximately 10%) traveling from the circuit board to the antenna. In one embodiment, coupler 20 is connected to active shields (or radiators) 14a-14c. Located between coupler 20 and active shields 14a-14c are adjustment circuits 22a-22c. Adjustment circuits 22a-22c each include variable phase shifters 24a-24c and variable gain amplifiers 26a-26c. Variable phase shifters 24a-24c substantially adjust the phase of the signal. As a result, the electromagnetic field strength produced by the antenna which may be absorbed by a user

is reduced in effect by the active shields 14a-14c in the region around the earpiece 10a.

Fig. 3 illustrates a block diagram of a second embodiment. Antenna 12 is connected through line 16 to circuit board 42 and controller 40 (e.g., a microprocessor). Coupler 20 is connected to active shields 36a and 36b. Between coupler 20 and active shields 36a-36b are located adjustment circuits 30a and 30b. Adjustment circuits 30a and 30b include variable phase shifters 32a-32b and variable gain amplifiers 34a-34b. The second embodiment further includes sensors 38a and 38b which are located near active shields 36a and 36b, respectively. The sensors measure the electromagnetic field strength in the environment of the shields 36a-36b and send feedback signals along lines 46a and 46b to the controller 40. (The controller 40 may be the main processor for the communication device 10 or it may be a dedicated processor for controlling the active shields 36a-36b). Controller 40 is coupled to the variable phase shifters 32a-32b through lines 44a and 48a. Controller 40 is coupled to the variable gain amplifiers 34a and 34b through lines 44b and 48b. Controller 40 adjusts the variable phase shifters and variable gain amplifiers in response to the readings from the sensors 38a and 38b. Although the second embodiment discloses each active shield with a sensor, in an

alternative embodiment there may be one feedback circuit monitoring and controlling a plurality of active shields.

It is understood that the present invention has been described hereinabove by way of example and by preferred embodiments and not as a limitation on the invention. It is to be realized that various changes, alterations, rearrangements and modifications can be made by those skilled in the art to which it relates without departing from the spirit and the scope of the present invention.